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AN ATTRACTANT FOR MUSHROOM FLIES (DIPTERA: PHORIDAE)

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Abstract.—Several undescribed *Megaselia* spp. and *M. pluralis* (Wood) in this large genus of mushroom flies were attracted to 1-phenylethanol in field tests. The highest concentration captured the most flies when the concentration ranged from 1–50%. Also, 2-phenylethanol was a weak attractant and captured ca. 10-fold fewer flies than did 1-phenylethanol. A 1:1 ratio of these compounds captured significantly fewer flies than did 1-phenylethanol alone. We predict these compounds will prove to be attractants for other mushroom flies.

Most phorid flies feed on decaying animal or vegetable matter and play an important role in recycling of nutrients. Members of the genus *Megaselia* occur in a wide range of habitats throughout the world (Robinson, 1971). The mushroom fly, *Megaselia halterata* (Wood), is a well-known member of this taxon because it is a pest of cultivated mushrooms. In fact, a large number of *Megaselia* spp. feed on fungi, and more species may become pests due to increased mushroom production throughout the world (Chang and Miles, 1984). Work is currently underway in Europe to identify volatile components present in mushroom house air capable of modifying oviposition behavior of *M. halterata* (Grove and Blight, 1983). Preliminary field tests identified several compounds with biological activity.

During investigations in search of chemicals that modify behavior of forage pests (Buttery et al., 1982, 1984), a compound was discovered that attracted several species of *Megaselia*. We report here the results of subsequent field tests in several types of habitat containing phorid flies.

MATERIALS AND METHODS

Field tests were conducted near Corvallis, Oregon, in the following habitats: red clover grown for seed, bluegrass grown for seed, mixed grass pasture, and a grove of oak trees with an understory of litter and mixed grasses. Pherocon 1 C traps were used in all tests with the bait placed in the center of the trap. Baits were prepared by dispensing 1 ml of the test compound (in hexane) into 11 × 17-mm red rubber stoppers (A. H. Thomas Co., Philadelphia, PA 19105) just prior to a test. The dosage of test compound ranged from 1 to 50% based on ml of compound per ml of hexane. Four replicates of each test concentration were exposed in the field at each test site in a randomized block design. Traps were positioned at least 20 m from other traps. Each replicate included an unbaited check trap that contained a stopper impregnated

Table 1. Number of *Megaselia pluralis* (Wood) in Pherocon 1 C traps (± standard deviation) baited with 10% 1-phenylethanol in different habitats.

Date	Red clover	Bluegrass	Understory in stand of oak	Mixed grass pasture
April 30–May 4	0	4 (1)	0	80 (4.2)
June 5–11	45 (8.3)	0	0	162 (14.5)
July 9–13	118 (14.9)	66 (14.7)	453 (1.51)	227 (15.6)
August 6–10	346 (7.23)	6 (1.1)	189 (1.31)	99 (10.6)
September 10–14	8 (0.7)	13 (3.1)	26 (1.9)	57 (8.7)

with hexane only. In the habitat test, traps were deployed in each field for 5 days during the first week of each month from May through September.

RESULTS

The initial discovery that 1-phenylethanol was an attractant for phorids was made in a field of red clover. A subsequent test was made in the same field to confirm the observation and determine the effect of dosage on trap catch. This test included traps baited with 1, 5, 10, and 50% 1-phenylethanol and unbaited check traps. During September 21–26, 1983, four traps of each dosage captured 80, 377, 823, 1,145, and 11 *Megaselia* spp. specimens, respectively. At least three *Megaselia* species were captured and all were undescribed species. Voucher specimens of all species captured in these studies are in the insect collection at Virginia Polytechnic Institute and State University.

In 1984, a second test was conducted on different types of habitat using baits of 10% 1-phenylethanol. The only phorid captured in all habitats was *Megaselia pluralis* (Wood) (Table 1). Based on these captures, the species was most abundant from June–August with an apparent peak in numbers during July. All habitats sampled revealed some *M. pluralis,* which suggests that the species is common in many types of habitat throughout the Willamette Valley of Oregon. This species has a wide distribution and occurs in a large number of habitats (Robinson, 1981).

In an attempt to increase trap catch, we decided to test 1-phenylethanol, in combination with the related compound 2-phenylethanol, a known attractant for anthomyiid flies (Ishikawa et al., 1983). Four traps of each dosage and/or combination shown in Table 2 were exposed in the field for three days during mid-August 1984. The 2-phenylethanol alone was a weak attractant compared with 1-phenylethanol. None of the combinations of 1- and 2-phenylethanol produced trap catches comparable to 1-phenylethanol alone.

DISCUSSION

These tests have shown that 1-phenylethanol is an attractant for both sexes of a number of species of *Megaselia* also known as mushroom flies. Flies definitely initiated upwind anemotaxis in response to 1-phenylethanol and were capable of following a concentration gradient to the source in a trap. However, many flies did not enter the trap and instead aggregated in the vicinity of the trap, which suggests that

Table 2. Capture of *Megaselia pluralis* (Wood) in Pherocon 1 C traps baited with 10% 1-phenylethanol, 10% 2-phenylethanol or combinations in different ratios.

ml/bait		
1-phenylethanol	2-phenylethanol	No. captured*
1	0	510 a
0	1	34 b
0.1	0.9	98 c
0.9	0.1	266 d
0.5	0.5	330 d

* Means followed by the same letter do not differ significantly.

1-phenylethanol may function as an aggregation attractant. Grove and Blight (1983) reported several compounds unrelated to 1-phenylethanol as having some activity on *M. halterata* but found no 1-phenylethanol in mushroom house air. However, both 1- and 2-phenylethanol and also the closely related acetophenone occur in mushrooms (Pyysalo, 1976; Yajima et al., 1981). None of these compounds has the type odor commonly associated with mushrooms. At present, 1-phenylethanol appears to be the most potent known attractant for *Megaselia* spp. with the possible exception of the sex pheromone of *M. halterata* (Baker et al., 1982).

We suspect that 2-phenylethanol may be an attractant for other species of *Megaselia* because of the inhibitory effect on trap catch in our tests when used in combination with 1-phenylethanol, indicating a sensitivity to both compounds. Often related compounds have similar functions in other species. Indeed, 1- and/or 2-phenylethanol may prove to be an attractant for other *Megaselia* species, including the mushroom fly. We predict that 2-phenylethanol will prove as attractive to other species of *Megaselia* as 1-phenylethanol is to *M. pluralis* and the undescribed species captured in our tests.

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